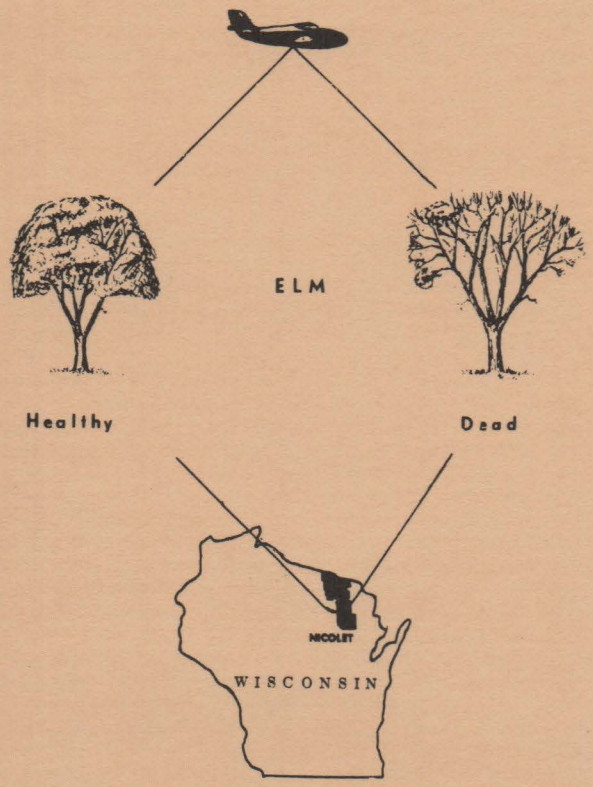
Forest Insect & Disease Management

Survey Report

S-26-75

December 1975

DUTCH ELM DISEASE
NICOLET NATIONAL FOREST, WISCONSIN
USING REMOTE SENSING



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INTRODUCTION

The Nicolet National Forest, located in northeast Wisconsin, encompasses approximately 207,000 acres of northern hardwoods. Elm is a major component of the forest resources along the rivers. Since the current status of Dutch elm disease (DED) and its impact on the forest was unknown, the St. Paul Field Office was asked to evaluate the situation along parts of the major east and west watersheds.

OBJECTIVE

The purpose of this study was to determine the current and future impact of Dutch elm disease on the eastern part of seven rivers on the Nicolet National Forest.

METHODS

During July 1975, 19 miles of the Brule River Watershed, 10 miles of the Pine River Watershed, 11 miles of the Popple River Watershed, 15 miles of the Peshtigo River Watershed, 15 miles of the Rat River Watershed, 13 miles of the Oconto River Watershed and 10 miles of the Waupee Creek Watershed on the Nicolet National Forest were photographed at a 1:12,000 scale using an RC-10 camera mounted in an Aero Commander. The photography was taken by Aviation Management from Region 9, Milwaukee, Wisconsin. The photography was a 9x9 inch color infrared transparency format type. The photographed areas were located on a one-half-inch-to-the-mile Forest Service map for ground reference data. The elm mortality areas were located on each image and classified as heavy mortality (more than an average of 1 tree per acre) or moderate to light mortality (between 0.1 to 0.9 trees per acre). The number of dead and dying elms was recorded for each disease center on the image. Twenty-five disease centers were selected for ground comparison. All data were adjusted using linear regression.

The tree species, diameter at breast height (d.b.h.), number of logs, tree condition and cause of condition were recorded for each tree in each ground checked infection center.

The average volume for dead and dying elm and standard error of the mean were calculated using the volumes obtained from the ground truth correlation. The average volumes were then applied to the total number of dead and dying elms on the photographed area.

RESULTS AND DISCUSSION

Interpretation of the photography revealed that Dutch elm disease occurs throughout the watersheds. The disease is well established throughout the areas on the Waupee (Figure 1), Oconto (Figure 2) and Peshtigo (Figure 3) as heavy. The mortality was classified as moderate throughout most of the area on the Brule Watershed (Figure 4). Mortality on the Pine (Figure 5) and Rat (Figure 6) watersheds was located on the eastern half of photographed areas, with approximately one half of the mortality classified as heavy. Half of the mortality on the Popple Watershed (Figure 7) was found on the eastern half of the remote sensed area and classified as heavy. Dutch elm disease is scattered and light throughout most of the upland areas photographed.

Of the 120,830 acres surveyed 1,297 acres of heavy mortality were noted on National Forest land (Table 1). A total of 1,194 acres were classified as moderate to light mortality on National Forest land. Of the 11,963 elm trees found dead or dying on the 120,830 acres, about 65 percent were on Federal land (Table 2). Two percent were dead or dying from causes other than Dutch elm disease.

We found 716,090 bd ft of standing dead elm on National Forest and 340,800 bd ft of dead elm on other ownership plus 212,020 bd ft of elm that died in 1975 on National Forest and 72,860 bd ft that died in 1975 on other ownerships.

The annual rate of mortality will increase each year until the resource is depleted. An 80% mortality of the total elm resource is expected on the Forest by 1985.

The acreage figures and numbers and volume of dead and dying elms are summarized for each watershed area in Tables 1 and 2. Linear regression was used to adjust the data and the correlation was .88.

MANAGEMENT CONSIDERATIONS

The following action plan is recommended to reduce the rate of Dutch elm disease spread and mortality.

1. Establish and keep current a map of all Dutch elm disease on the National Forest.

2. Develop elm harvest zones. (When possible, harvest during September to December to help reduce beetle populations and the rate of spread.)

   a. Establish Red zones within 1 to 2 miles* of known infection centers (20 trees or more). Initiate accelerated harvest of elm resource within this zone.

   b. Establish Yellow zones within 2 to 10 miles* of known infection centers. Initiate an accelerated harvest of valuable elm stands and conduct an inventory of the remaining elm resource.

   c. Establish Blue zones within 10 to 15 miles* of known infection centers. Conduct normal sales operation. Maintain an intensive inventory of the elm resource for future harvest information.

3. Limit shipment of elm logs with bark intact to September-December when possible.

4. Eliminate stockpile of elm logs at mills or in the forest during May-July when possible. Debarked or chipped elm wood is safe at any time.

Other considerations such as manpower, equipment, economics, markets, etc., should be looked at for planning a program that best meets the needs for elm management on the Nicolet National Forest.

*Distance should be adjusted to coincide with management objectives.

Table 1. Extent and intensity of elm mortality, by watershed, Nicolet N.F., 1975

Watershed	Acres Photographed	Acres Heavy Mortality		Acres Moderate to Light Mort.		Total Mortality NF/PR
		National Forest	Private	National Forest	Private	
Brule	24,750	125	50	550	23	748
Pine	12,200	50	50	75	50	225
Popple	14,130	65	250	20	200	535
Peshtigo	19,200	325	250	275	200	1,050
Rat	17,900	87	112	62	75	336
Oconto	17,300	425	100	87	150	762
Waupee	15,350	220	75	125	60	480
Total	120,830	1,297	887	1,194	758	4,136

Table 2. Number and volume of dead and dying elm by watershed, Nicolet National Forest, Wisconsin.

Watershed	No. Dead Elm Trees		No. Dying Elm Trees		Mortality Unknown		Total Mortality	Volume (bd ft)				Total Volume
								Dead Elm		Dying Elm		
	NF[1/]	PVT[2/]	NF	PVT	NF	PVT		NF	PVT	NF	PVT	
Brule	499	386	128	99	13	10	1,135	55,880 ± 3,990	43,230 ± 3,080	16,640 ± 1,530	12,870 ±1,180	128,620 ± 9,780
Pine	199	46	51	11	5	1	313	22,280 ± 1,590	5,150 ± 360	5,710 ± 400	1,230 ± 80	3,437 ± 2,430
Popple	86	357	22	91	2	9	567	9,630 ± 680	39,980 ± 2,850	2,860 ± 260	11,830 ±1,090	64,300 ± 4,880
Peshtigo	1,731	821	443	210	44	21	3,270	193,870 ±13,840	103,150 ± 6,560	57,590 ± 5,310	27,300 ±2,520	381,910 ± 28,230
Rat	189	443	48	112	11	5	808	21,168 ±15,110	49,610 ± 3,540	6,240 ± 570	14,560 ±1,340	91,578 ± 20,560
Oconto	2,321	780	595	200	59	20	3,975	259,950 ±18,560	87,360 ± 6,240	77,350 ± 7,140	26,000 ±2,400	450,660 ± 34,340
Waupee	1,369	110	351	28	35	2	1,895	153,320 ±10,950	12,320 ± 880	45,630 ± 4,210	3,640 ± 330	14,910 ± 10,370
Total	6,394	2,943	1,638	751	169	68	11,963	716,090 ±64,720	340,800 ±23,510	212,020 ±19,420	72,860 ±8,940	1,341,770 ± 115,590
Percent	54	24	14	6	1	1						

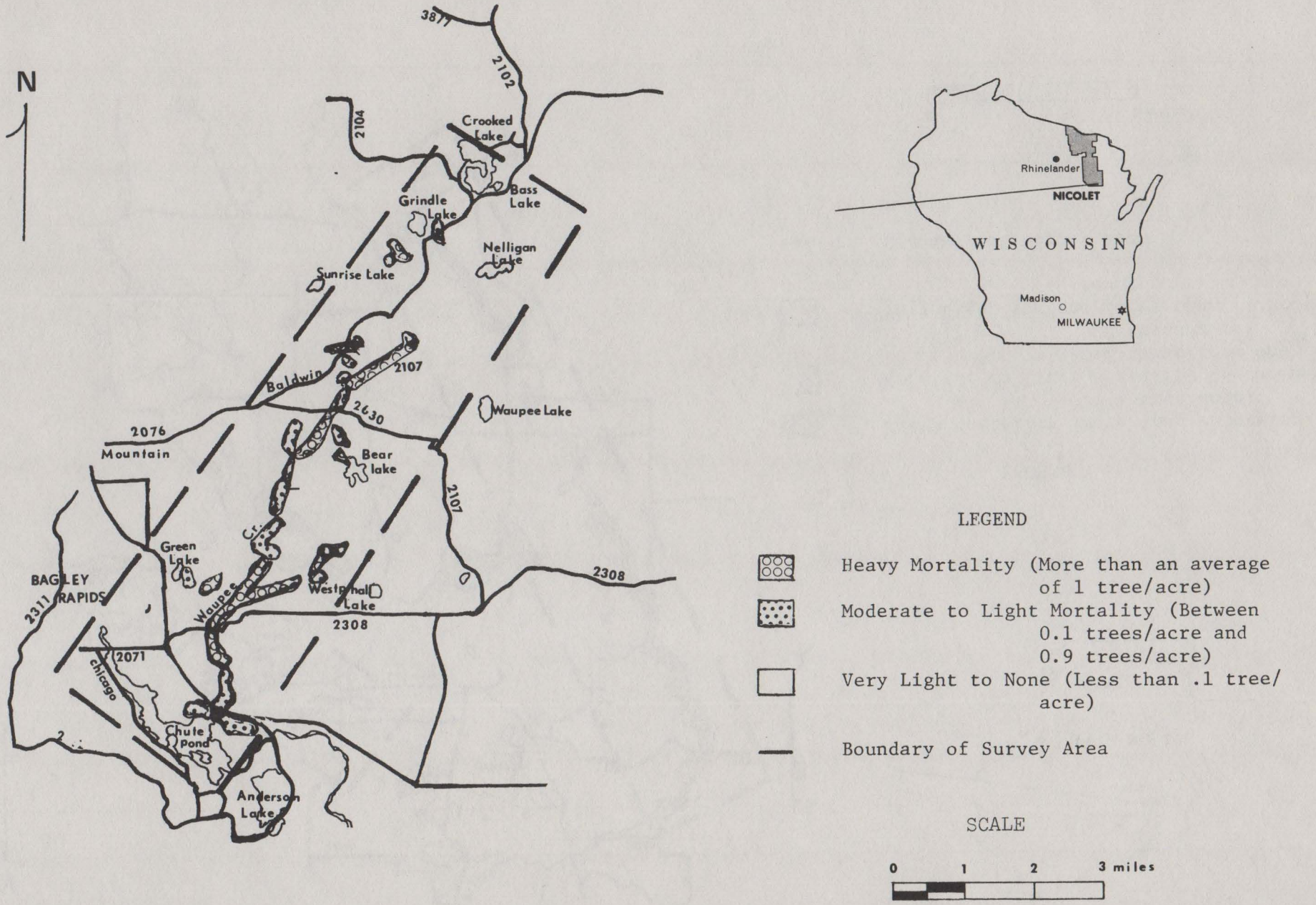


Figure 1. Elm Mortality Along 10 Miles of the Waupee Creek.

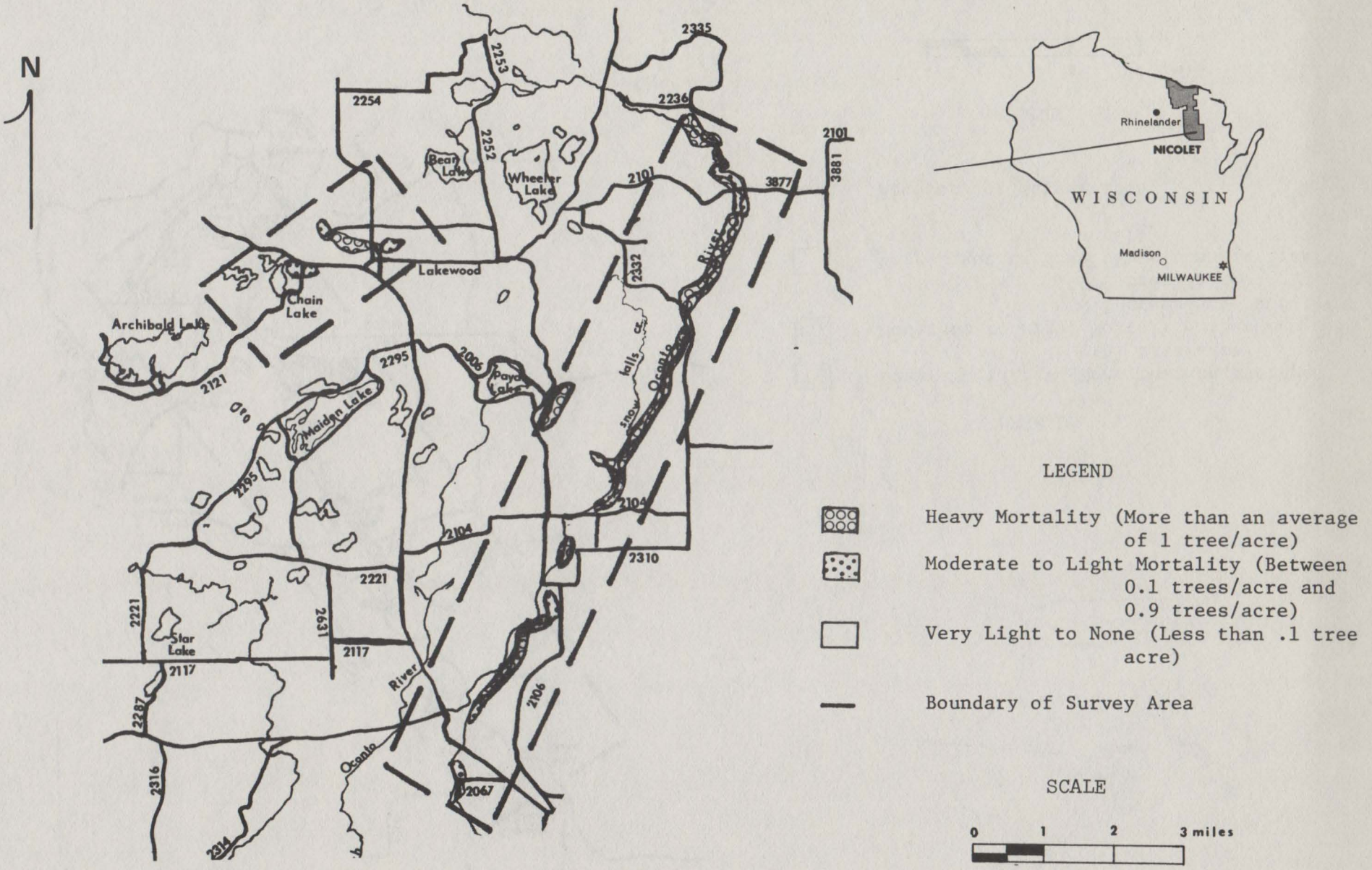


Figure 2. Elm Mortality at Lakewood and Along 13 Miles of the Oconto River.

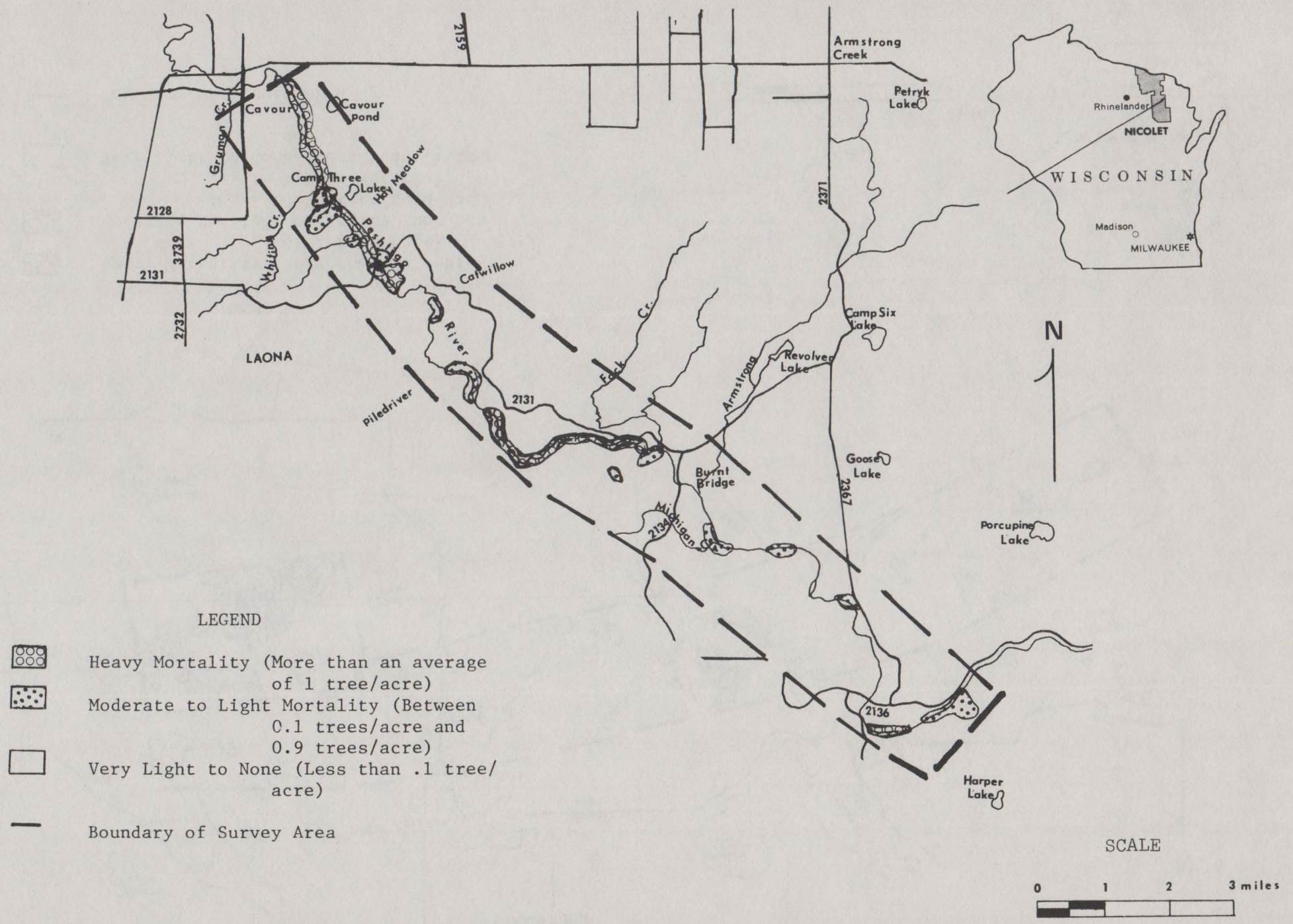
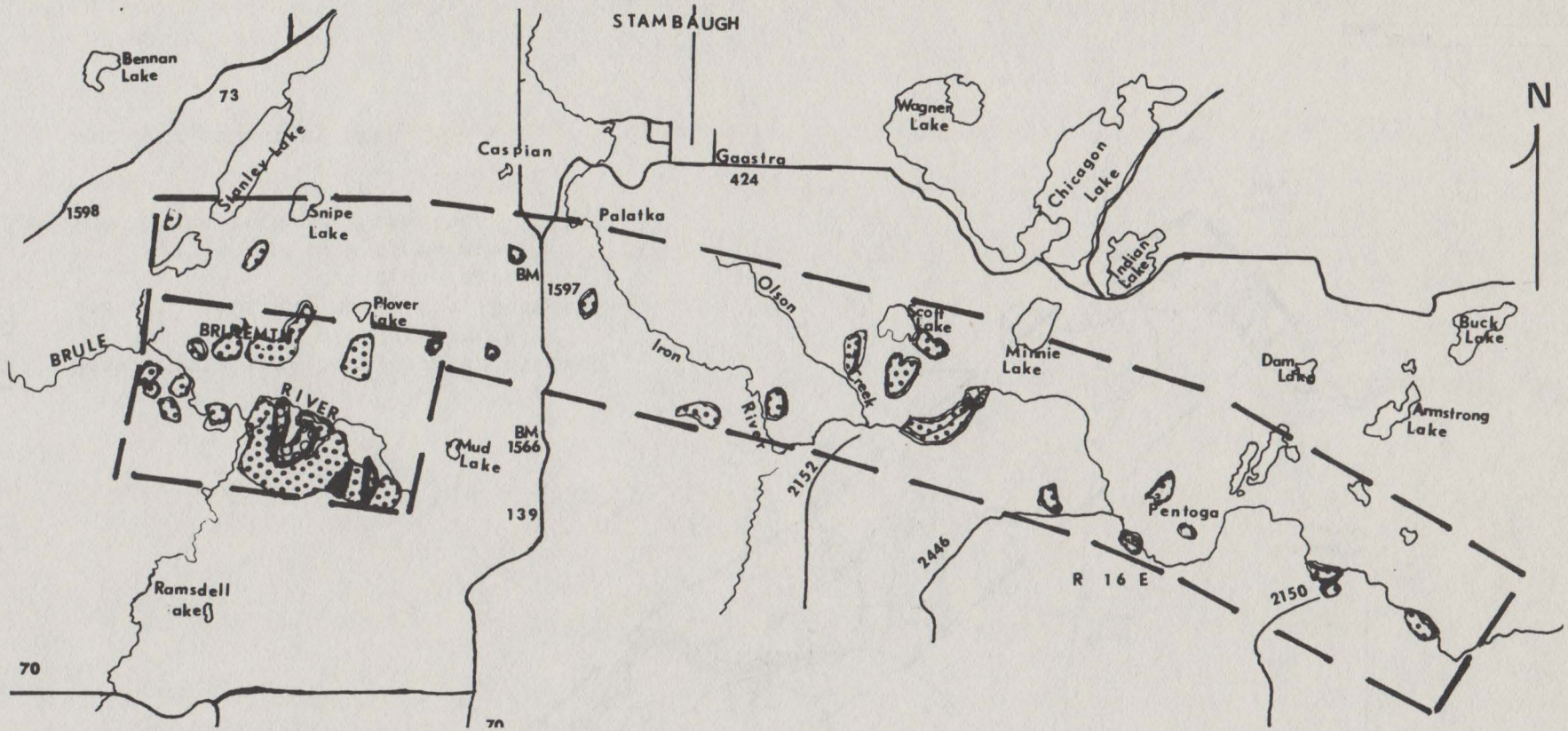


Figure 3. Elm Mortality along 15 Miles of the Peshtigo River.



LEGEND

- Heavy Mortality (More than an average of 1 tree/acre)
- Moderate to Light Mortality (Between 0.1 trees/acre and 0.9 trees/acre)
- Very Light to None (Less than .1 tree/acre)
- Boundary of Survey Area

SCALE

0 1 2 3 miles

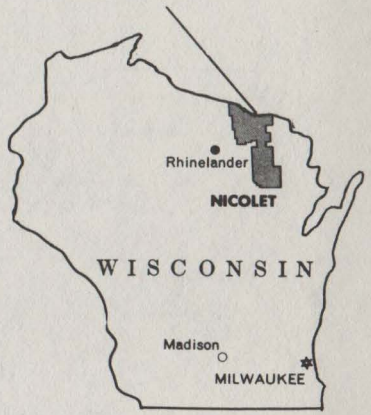


Figure 4. Elm mortality along 19 miles of the Brule River

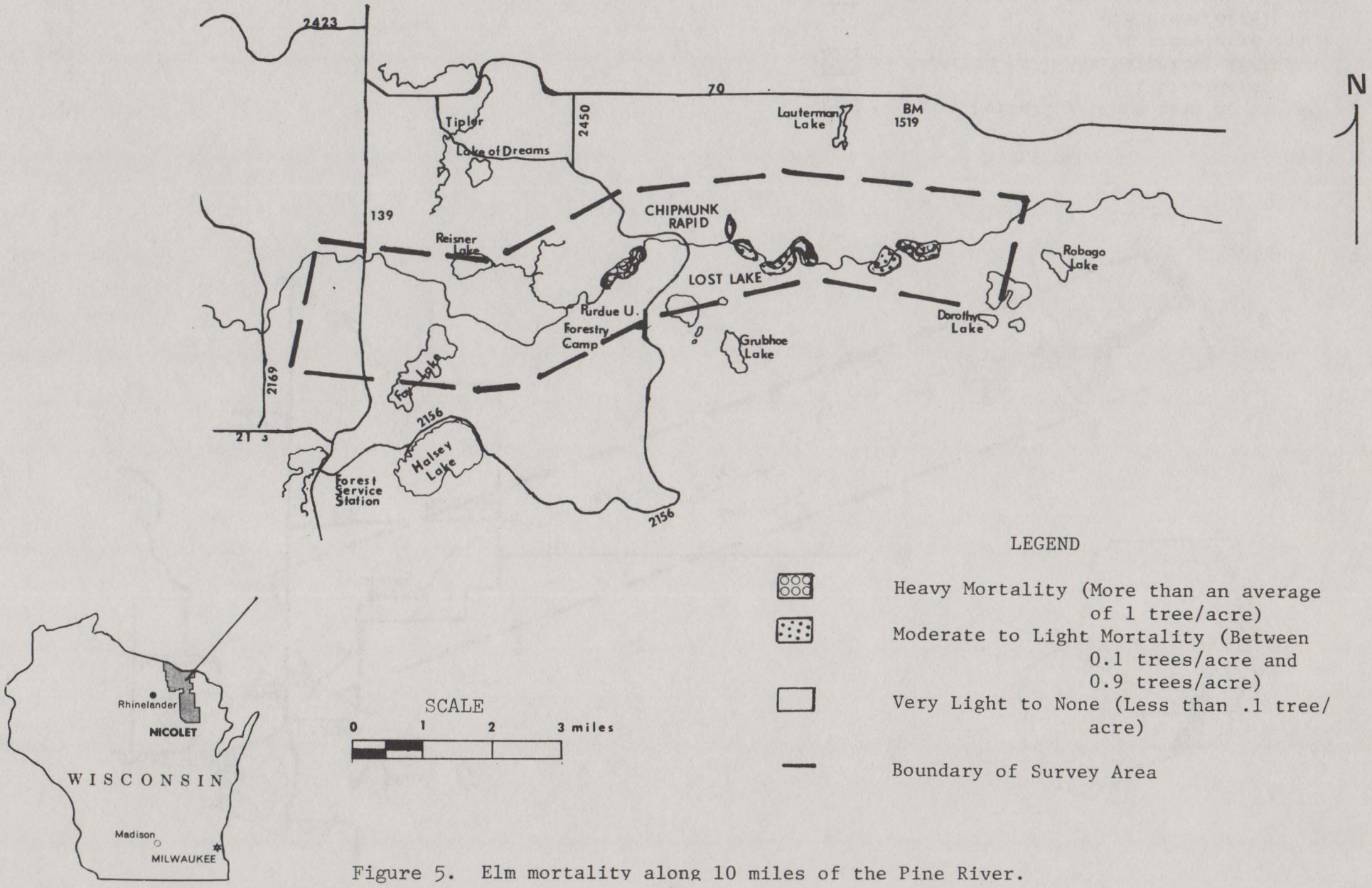
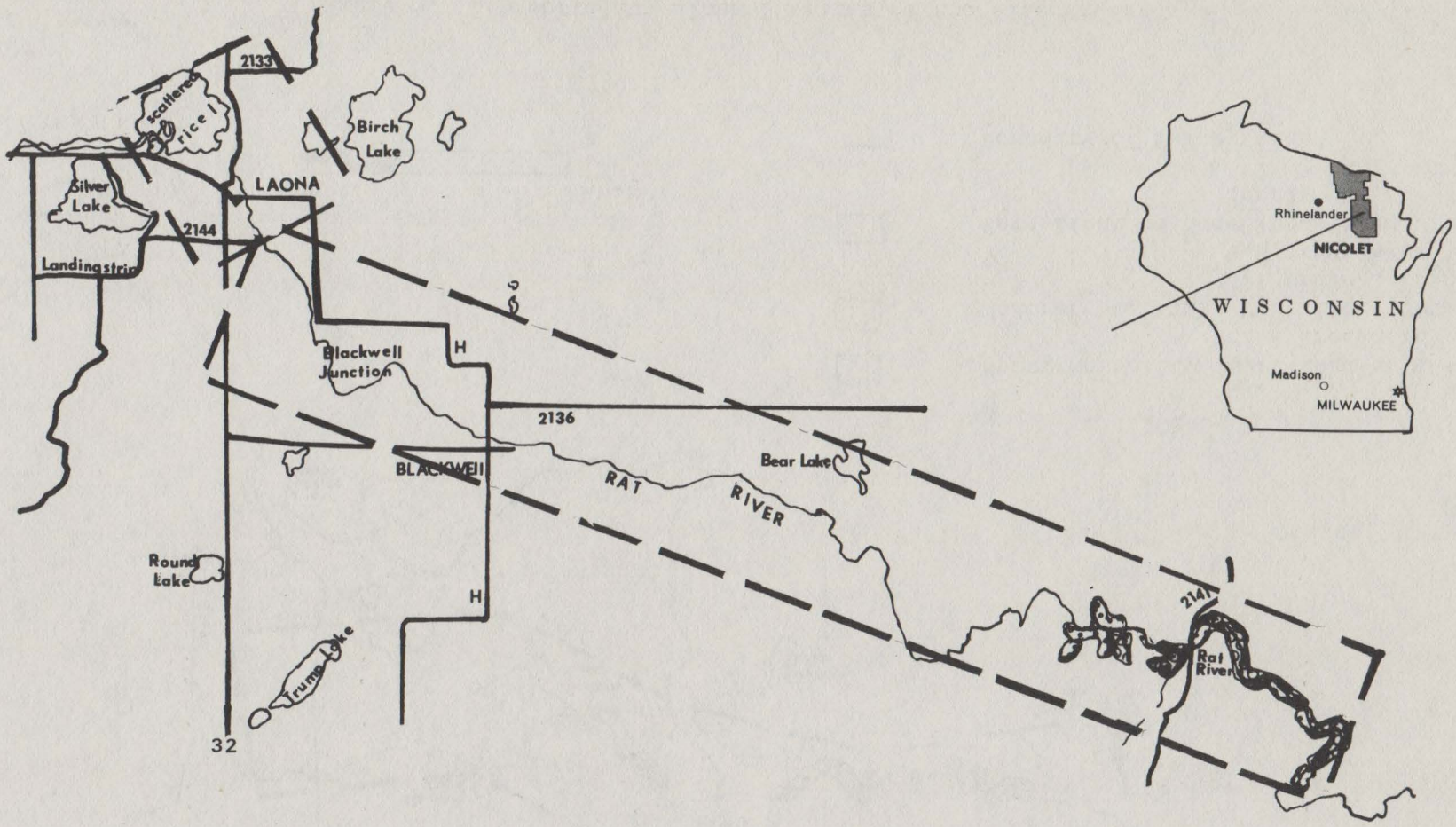


Figure 5. Elm mortality along 10 miles of the Pine River.



N

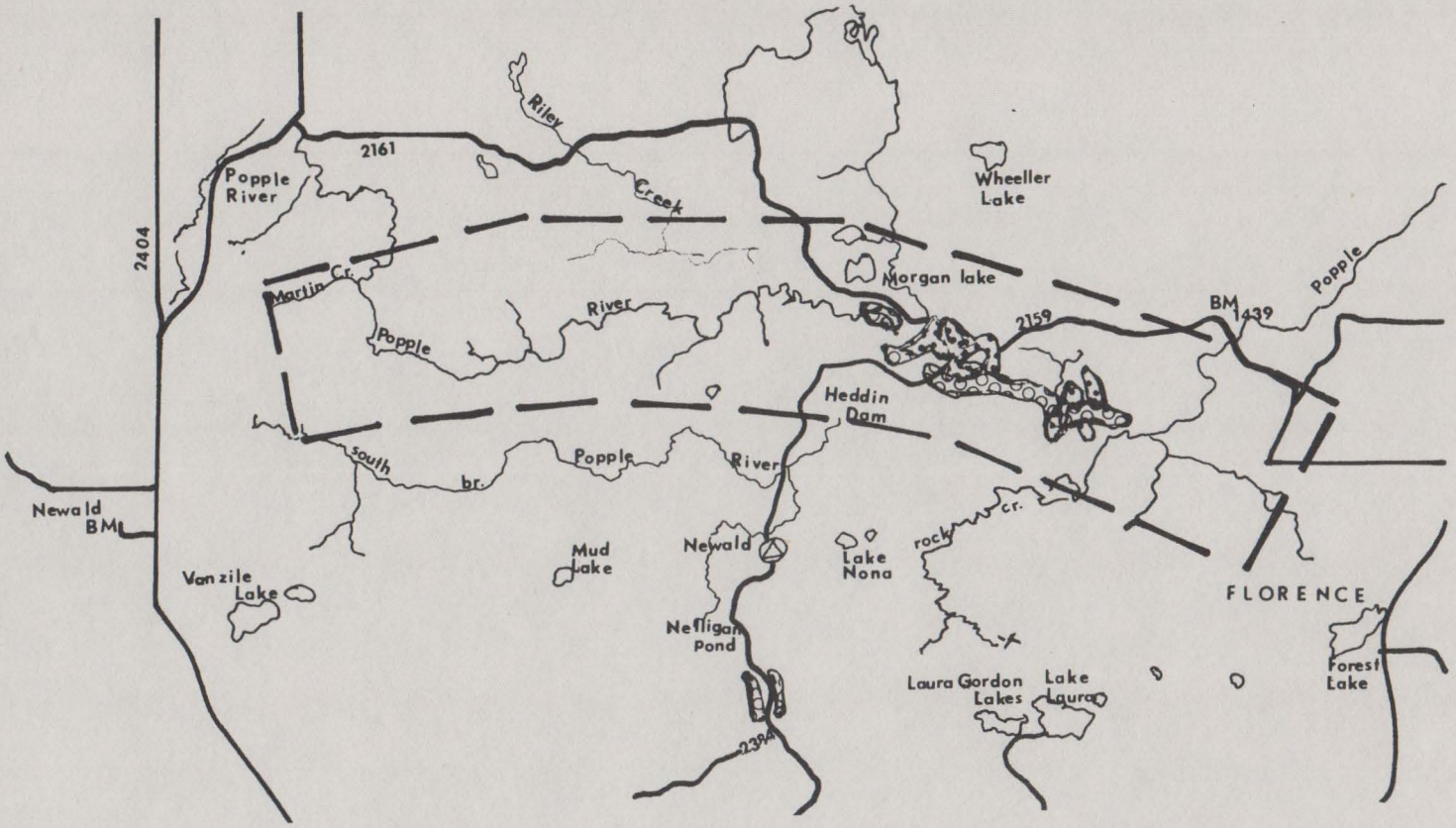
SCALE

0 1 2 3 miles

LEGEND

- Heavy Mortality (More than an average of 1 tree/acre)
- Moderate to Light Mortality (Between 0.1 trees/acre and 0.9 trees/acre)
- Very Light to None (Less than .1 tree/acre)
- Boundary of Survey Area

Figure 6. Elm Mortality Along 15 Miles of the Rat River.



LEGEND

Heavy Mortality (More than an average of 1 tree/acre)

Moderate to Light Mortality (Between 0.1 trees/acre and 0.9 trees/acre)

Very Light to None (Less than .1 tree/acre)

Boundary of Survey Area

SCALE

0 1 2 3 miles

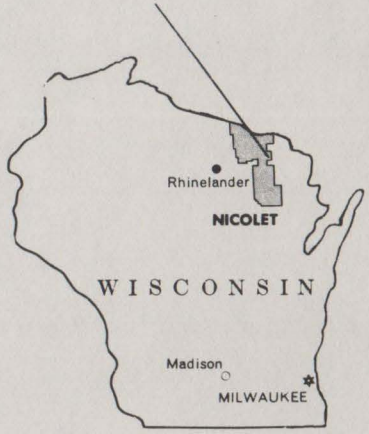


Figure 7. Elm Mortality Along 11 Miles of the Popple River.